ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor (RJIF): 8.69
IJAR 2025; 11(10): 379-383
www.allresearchjournal.com
Received: 02-08-2025
Accepted: 05-09-2025

Dr. Padmanabh D Mulay
Junior Resident, Department of Orthopaedics, ACPM Medical College, Dhule, Maharashtra, India

Dr. Apoorva D Mulay
Junior Resident, Department of Orthopaedics, Bharati Vidyapeeth Medical College, Pune, Maharashtra, India

Dr. Yash Goyal
Associate Professor, Department of Pharmacology, ACPM Medical College, Dhule, Maharashtra, India

Dr. Prashant More
Senior Resident, Department of Orthopaedics, ACPM Medical College, Dhule, Maharashtra, India

Dr. Akshay Kulkarni
Associate Professor, Department of Surgery, ACPM Medical College, Dhule, Maharashtra, India

Corresponding Author:
Dr. Padmanabh D Mulay
Junior Resident, Department of Orthopaedics, ACPM Medical College, Dhule, Maharashtra, India

Mutilating hand injuries: Clinical management & challenges

Padmanabh D Mulay, Apoorva D Mulay, Yash Goyal, Prashant More and Akshay Kulkarni

DOI: https://www.doi.org/10.22271/allresearch.2025.v11.i10e.12967

Abstract
Background: Severe hand trauma can lead to extensive soft tissue and skeletal defects, necessitating advanced orthopaedic & plastic surgical reconstruction to optimize both functional and aesthetic outcomes.
Materials and Methods: This retrospective study analyzed patients with severe hand injuries treated between October 2023 and August 2025, who underwent either surgical or non-surgical management. Data collected included the extent of tissue damage, the number of surgical procedures performed, treatment strategies, and the mean hospital stay, which was recorded from the presentation of patient in casualty and admission and discharged to the final treatment.
Results: A total of 34 patients were included in the analysis, of whom presented with severe degloving injuries. The mean age of the patients was 35.21 ± 10.11 years, with the majority aged between 21 and 57 years. The most common injury types were crush injuries (47.1%), degloving injuries (20.6%), and multiple traumatic amputations (26.5%), with grinder/sugarcane expeller machine accidents accounting for 67.6% of cases. Patients underwent an average of 2.62 ± 1.18 surgical procedures, including skin grafting (29.4%), replantation (26.5%), and pedicled flap reconstruction (17.6%). 58.8% of patients had an uncomplicated postoperative course.
Conclusion: This study highlights the challenges involved in treating severe hand injuries, where repeated surgical procedures frequently lead to less-than-ideal results due to issues like infection and joint stiffness. The results stress the need for prompt intervention.

Keywords: Mutilating hand injuries, amputation, reconstructive surgery, debridement level of evidence - IV

Introduction
The term “mutilating hand injuries” refers to severe, complex injuries involving damage to multiple tissues [1]. These injuries frequently result from high-energy trauma, such as industrial accidents, household injuries caused by kitchen appliances (e.g., entrapment in a mixer grinder), road traffic accidents, firearm-related trauma, or agricultural injuries (e.g., thresher machine accidents) [2] or sugarcane expeller machine injuries. Any injury that causes extensive tissue damage across multiple structures, including skin, soft tissue, tendons, nerves, and bone, is classified as a mutilating hand injury. Due to the wide variability in injury patterns developing standardized treatment protocols remains difficult.
The main goal in treating mutilating hand injuries is to restore functional ability as effectively as possible, supporting an early return to work and daily life. This article outlines our approach to managing such injuries, with a focus on optimizing functional outcomes through intraoperative assessment and the selection of suitable reconstructive techniques.

Materials and Methods
This retrospective cohort study evaluated the clinical records of patients who sustained mutilating hand injuries and underwent reconstructive procedures between October 2023 and August 2025 at our institute. The inclusion criteria is mutilating hand as defined in introduction. Pediatric hand injuries and polytrauma cases with involvement of multiple organ systems were excluded from the study.

Only those patients with fully documented treatment histories were considered. Each patient's clinical course was evaluated from the point of initial trauma care, through the series of indicated surgical procedures, and until the completion of their treatment at the hospital.
The recorded parameters included the extent of injured tissue, the number of surgical procedures performed, treatment modalities, and the mean duration of hospital stay, measured from presentation of patient in casualty and admission and discharged to the final treatment. Complications encountered during the hospital stay were also documented. Based on the inclusion and exclusion criteria, 34 cases were included in the analysis, ranging from fingertip injuries to extensive mutilating hand trauma.
Prior to initiating the study, ethical approval was obtained from the hospital's local Ethical Committee. Data was analyzed statistically.

Results

The majority of the patients belonged to the 21 to 30 years (35.3%) and 31 to 40 years (29.4%) age groups. The most common diagnosis was crush injury of the hand and in terms of the mechanism of injury, most common was grinder machine accidents as mentioned in abstract. Hospital stays ranged from 9 to 31 days, with a mean duration of 16.82 ± 5.385 days. The time from injury to initial surgery ranged from 2 to 12 hours, with a mean duration of 5.69 ± 2.555 hours.
In terms of treatment modalities, 29.4% of patients underwent skin grafting, 26.5% underwent replantation, 17.6% had pedicled flap reconstruction, 14.7% underwent free flap procedures, and 11.8% had secondary wound closure. Among all patients, 58.8% experienced no complications, while 35.3% developed infections, and 5.9% had non-viable fingers. Additionally, 17.6% of patients required intravenous antibiotic therapy, 11.8% underwent finger amputations, 5.9% had debridement, and 5.9% underwent both debridement and skin grafting. Regarding functional outcomes, 55.9% of patients were expatriates who returned to their hometown after treatment, 23.5% had poor outcomes, 14.7% experienced joint stiffness, and 5.9% had good outcomes.
The hospital stay varied depending on the presence of complications. In patients without complications, the hospital stay ranged from 9 to 31 days, with a mean duration of 16.90 ± 5.794 days. For patients with infections, the duration ranged from 10 to 28 days, with a mean of 17.17 ± 5.167 days. Patients with non-viable fingers had hospital stays ranging from 12 to 16 days, with a mean duration of 14.00 ± 2.828 days. The time from injury to initial surgery also varied based on the presence of complications. Among patients without complications, the duration ranged from 2 to 10 hours, with a mean of 5.55 ± 2.528 hours. For patients with infections, the duration to surgery ranged from 3 to 12 hours, with a mean of 5.71 ± 2.734 hours. Patients with non-viable fingers underwent their initial surgery between 5 and 9 hours after the injury, with a mean duration of 7.00 ± 2.828 hours.
The outcomes also varied according to the number of surgeries performed. Among the 9 patients who underwent a single surgery, 7 (36.8%) were expatriates who returned to their hometown, and 2 (40.0%) developed joint stiffness, while none had fair or good outcomes. Of the 5 patients who underwent 2 surgeries, 2 (25.0%) achieved fair outcomes, and 1 (20.0%) developed joint stiffness, with no patients achieving good outcomes. Among the 10 patients who underwent 3 surgeries, 4 (21.1%) were expatriates, 2 (25.0%) had fair outcomes, 2 (100%) achieved good outcomes, and 2 (40.0%) experienced joint stiffness. Among the 10 patients who underwent 4 surgeries, 6 (31.6%) were expatriates, and 4 (50.0%) had fair outcomes, with none experiencing good outcomes or joint stiffness. The Chi-square statistic for the association between the number of operations and outcomes was 12.28, with a p-value of 0.198, indicating that there was no statistically significant association.
The outcomes also varied based on the presence or absence of complications. Among the 20 patients who had uncomplicated cases, 10 (52.6%) were expatriates who returned to their hometown, 6 (75.0%) had fair outcomes, 1 (50.0%) achieved a good outcome, and 3 (60.0%) experienced joint stiffness. Among the 12 patients with infections, 8 (42.1%) were expatriates, 2 (25.0%) had fair outcomes, 1 (50.0%) achieved a good outcome, and 1 (20.0%) developed joint stiffness. Of the 2 patients with non-viable fingers, 1 (5.3%) was an expatriate and 1 (20.0%) experienced joint stiffness, with no patients achieving fair or good outcomes. The Chi-square value for the association between complications and outcomes was 3.74, with a p-value of 0.711, indicating that there was no statistically significant association.

Discussion

This study on mutilating hand injuries revealed significant insights into patient demographics, injury types, and treatment outcomes. A total of 34 patients with mutilating hand injuries were included, with a mean patient age of 35.21 years. However, some authors have presented differing perspectives. Their findings indicate that while the overall incidence of hand injuries among elderly individuals may be lower than that in younger demographics, elderly men are more susceptible to injuries involving hazardous equipment, while elderly women face a higher risk of fractures following falls [3]. In the current study, injuries caused by grinder/sugarcane expeller machines were particularly prevalent, accounting for 67.6% of cases. The most common diagnosis was crush injury (47.1%), and the average hospital stay was 16.82 days.
The average number of surgical procedures per patient in this study was 2.62, which aligns with literature. Furthermore, the average hospital stay of 16.82 days underscores the extended recovery process, a finding that is supported by the study conducted by Agarwal *et al*., which emphasizes the role of early, aggressive management and rehabilitation in improving patient outcomes after severe hand injuries [1]. In the present study, 29.4% of patients received skin grafts, a finding consistent with the study by Basnayake and Ekanayake [4]. Additionally, 26.5% of patients underwent replantation, reflecting trends noted in the literature where replantation plays a key role in restoring hand function after traumatic injuries [5]. Pedicled flaps were used in 17.6% of cases, and free flaps were utilized in 14.7%. Amputation was necessary in 11.8% of cases, alongside other debridement procedures, underscoring the importance of meticulous management in cases of severe injury and tissue loss [6].
In terms of patient recovery, poor outcomes were reported in 23.5% of cases, reflecting the challenges in achieving

optimal hand function despite aggressive surgical management [5]. The Chang *et al*. study suggests that successful replantation procedures can lead to significant functional recovery, including the restoration of essential hand grips, such as the tripod grip, in many cases.

In this study, after the initial repair and reconstruction of vital structures damaged by the injury, priority was given to ensuring stable and definitive skin coverage for the affected hand in cases of soft tissue deficiency. The options for skin coverage ranged from simple split-thickness skin grafts to more complex flap procedures, including both pedicled and free flaps (Fig. 1a-1b and Fig. 2a-2b). The selected skin cover must provide a gliding surface for the underlying tendons to facilitate hand movement and functionality. Flaps were typically used in cases where tendons or vasculature were exposed due to severe tissue loss. In one case, a groin flap (Fig. 1c) was utilized, and in another, a free flap (Fig. 2c) was employed to achieve soft tissue coverage, showcasing the versatility and importance of flap-based reconstruction in managing these injuries.

Ultimately, the functional outcome incorporates several key variables. These include patient age, the mechanism and level of injury, ischemia time, the extent of tissue loss and destruction, contamination, associated trauma to structures at different levels, premorbid medical conditions, and the patient's compliance, motivation, and access to rehabilitation.

The importance of early soft-tissue coverage in hand injuries cannot be overstated. The reliance on skin grafting is notably higher than the 14.7% usage of free flaps in the present study, suggesting a preference for simpler reconstructive procedures in this particular population. Replantation was attempted in 26.5% of cases.

Existing literature indicates that successful replantation can achieve survival rates as high as 83.8%. In terms of flap usage, pedicled flaps were employed in 17.6% of cases, while free flaps were utilized in 14.7%, reflecting a balanced approach to flap-based reconstruction.

Secondary wound closure was used in 11.8% of cases, representing a less common treatment option compared to skin grafting and flap-based reconstructions.

Mutilated hand reconstruction is a highly complex task for hand orthopaedic surgeon and plastic surgeon, requiring a multidisciplinary approach to restore both form and function. However, the primary objective goes beyond merely restoring circulation. The aim is to create a functional hand by prioritizing key elements such as restoring an opposable thumb, providing two functional fingers, and maintaining stable and mobile joints. In the present study, a case of traumatic amputation of multiple fingers was successfully managed through replantation after a complex upper extremity amputation. Surgical interventions included meticulous debridement and the application of a full-thickness skin graft, followed by amputation at the metacarpophalangeal and interphalangeal joints of the second and third digits. (Fig. 3a to 3c).

No complications were reported in 58.8% of the cases, suggesting effective initial surgical management. However, the infection rate in this study was 35.3%, markedly higher than the 6.3% reported in the literature [6]. This discrepancy may be attributed to variations in patient populations, the severity of injuries, or differences in antimicrobial protocols. Non-viable fingers were noted in 5.9% of cases. Literature attributes non-viable fingers to inadequate blood supply, often caused by severe crush injuries or compromised vascularization during replantation attempts.

Infection management in the study population included the administration of intravenous antibiotics to 17.6% of patients. Finger amputations were performed in 11.8% of cases, consistent with Scherer *et al*.'s findings [6].

Debridement, a crucial component of wound management, was carried out in 5.9% of the patients. Additionally, 5.9% underwent debridement followed by skin grafting, highlighting the importance of timely debridement in reducing the bacterial load, preventing infection, and promoting wound healing.

The present study highlights a unique finding: 55.9% of the patients were expatriates who returned to their hometown after treatment. Research suggests that socioeconomic status and access to follow-up care significantly influence patient outcomes [5]. A poor outcome rate of 23.5% was observed. This emphasizes the critical role of multidisciplinary care, consistent follow-up, and patient compliance in achieving favorable post-surgical outcomes [5].

The study reports a stiffness rate of 14.7%, a frequent complication in mutilating hand injuries, which is consistent with the findings of Abdel shaheed, who attributed hand stiffness to inadequate rehabilitation or prolonged immobilization following surgery [7]. A good outcome rate of 5.9% was observed in this study, a figure notably lower than the 83.3% tripod grip achievement rate documented in the literature. Delays beyond 24 hours have been linked to increased infection rates in the literature, emphasizing the need for timely surgical intervention to minimize complications and improve outcomes [8].

The present study results demonstrate that while some patients with mutilating hand injuries achieve fair outcomes, overall success rates remain relatively low, particularly among those undergoing multiple surgeries. Analysis of surgical outcomes revealed that among patients who underwent only 1 surgery, 36.8% had good outcomes, while 40% experienced stiffness, and none achieved fair outcomes. For patients who underwent 2 surgeries, only 25% reached fair outcomes, with no reports of good outcomes. In contrast, 20% of patients undergoing 3 surgeries had good outcomes, although 40% developed stiffness. Among the group that underwent 4 surgeries, 50% achieved fair outcomes, but there were no good or stiffness reported. Statistical analysis using the Chi-square test revealed no significant association between the number of surgeries and functional outcomes ($p = 0.198$).

Approximately 75% of uncomplicated patients achieved fair outcomes, compared to only 50% of patients with infections who reported good outcomes.

Despite these findings, the present study did not observe a statistically significant association between the presence of complications and the final outcomes, as evidenced by a Chi-square value of 3.74 and a p-value of 0.711.

Fig 1: 1a- Degloving injury right hand – avulsion of the skin integument with critical vascularity of the fingers, 1b- After initial debridement of the hand, 1c - underwent groin flap for the soft tissue cover, 1d - 6 months post rehabilitation

Fig 2: 2a. - Degloving injury dorsum right hand, 2b - Post debridement status, 2c- Flap debulking + extensor tendon reconstruction, 2d- Post rehabilitation

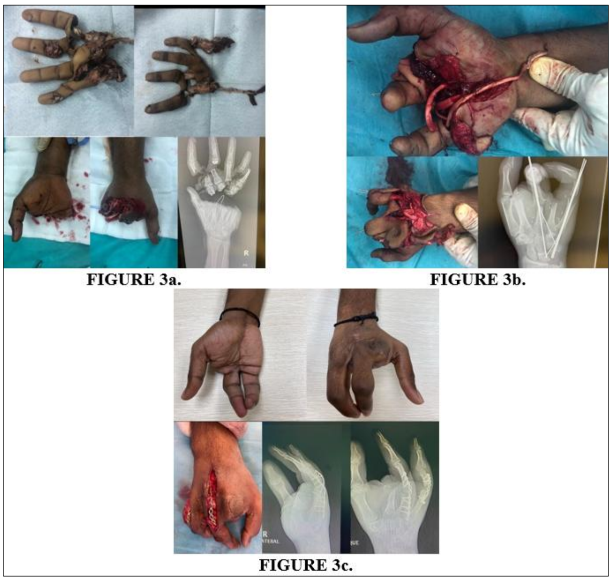

Fig 3: 3a.- Traumatic amputation multiple fingers, 3b- Replantation of the fingers, 3c- Reconstruction of the fingers – for tripod grasp

Conclusion

In conclusion, this study underscores the complexity of treating mutilating hand injuries and the multifactorial challenges involved in achieving optimal recovery. The findings indicate that despite multiple surgical interventions, functional outcomes can remain suboptimal due to complications such as infections, stiffness, and non-viable digits, which significantly impede the healing process. Early treatment emerges as a critical factor in improving recovery outcomes, with skin grafting and replantation identified as commonly employed techniques. However, the study emphasizes that the success of these procedures is influenced by various factors, including injury severity, patient compliance, and access to follow-up care.

Moreover, the findings shed light on areas where achieving consistent and desirable outcomes remains challenging, reinforcing the need for refined management protocols, multidisciplinary treatment strategies, and comprehensive rehabilitation programs to address long-term physical and psychological impacts.

References

1. Agarwal R, Agarwal D, Agarwal M. Approach to mutilating hand injuries. J Clin Orthop Trauma. 2019;10(5):849-52.
2. Chong KS. Principles in the management of a mangled hand. Indian J Plast Surg. 2011;44(2):219e226.
3. Perdue PW, Watts DD, Kaufmann CR, Trask AL. Differences in mortality between elderly and younger adult trauma patients: geriatric status increases risk of delayed death. J Trauma Acute Care Surg. 1998;45(4):805-10.
4. Basnayake O, Samarathunga D, Abeysekara P, Nadesan P, Wijayawardhana S, Ekanayake G, *et al*. Salvaging mangled upper limbs with early soft tissue cover with flaps-A. 2024.
5. Habarth TE, Rios-Diaz AJ, Davis HD, Amro C, Azoury SC, Broach RB, Lin IC, Chang B, Levin LS. D10. The True Story Behind Isolated Hand or Digit Traumatic Amputations: A One-year Evaluation of Traumatic Amputation Treatment Course and Success of Replantation. Plast Reconstr Surg Glob Open. 2023;11(4S):66-7.
6. Scherer J, Hax J, Teuben MP, Pape HC, Lefering R, Sprengel K, *et al*. Epidemiology and mortality of surgical amputations in severely injured patients with extremity injuries-A retrospective analysis of 32,572 patients from the TraumaRegister DGU®. J Clin Med. 2024;13(22):7000.
7. Abdelshaheed ME. Classification and clinical evaluation of "spare parts" procedures in mutilating hand injuries. Hand Surg Rehabil. 2021;40(1):75-80.
8. Pavan F, Albarki HS, Vu J, Keating C, Leong JC. Does delay to theater lead to increased infection rates in hand trauma? A retrospective cohort study. Plast Reconstr Surg Glob Open. 2018;6(11):e2025.